Northeast Salmon Team Fact Sheet Collection

Designating Critical Habitat

Atlantic salmon have several distinct life history phases that are identified by specific changes in their behavior, physiology, and habitat requirements. The growing ecological footprint of humans has resulted in certain Atlantic salmon habitat requirements not being met and subsequently their listing under the Endangered Species Act (ESA).

Under the ESA, a species' *critical habitat* (CH) refers to the physical or biological features, or *primary constituent elements* (PCEs), essential for its survival, reproduction, and ultimately, recovery. The ESA requires that a listed species' CH be designated by either the U.S. Fish and Wildlife Service or NOAA-Fisheries Service at the time of its listing. In reality, however, designation often occurs after the listing and sometimes not at all. There are several reasons for this.

First, while there is oftentimes a plethora of information on the threats facing imperiled species, information on their actual optimal habitat requirements is frequently lacking. To designate CH, PCEs must be identified (an enormous task in itself) and associated with an actual geographical area. Additionally, public comment on the CH designation and a complete economic analyses of the designation's impacts must occur before the designation's finalization. This process is inherently time consuming and costly. Second, as a species cannot exist in the absence of habitat, CH designations are sometimes perceived as duplicating protections already afforded under the ESA through listing.

However, designating CH affords species additional and very important protections under the ESA that a listing does not. For instance, listing a species under the ESA as threatened or endangered often implies that the range of the species has shrunk significantly.

Designating CH requires a determination of whether the current range of the species is adequate or if additional habitat within the species' historic range is required to ensure the species' continued existence into the foreseeable future (100 years). Designating unoccupied habitat that is essential for a species' recovery is the only mechanism through the ESA that ensures its protection and availability to the species.

ENDANGERED SPECIES ACT OF 1973

AN ACT To provide for the conservation of endangered and threatened species of fish, wildlife, and plants, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the ''Endangered Species Act of 1973''.

Section 3(5)(A) The term ''critical habitat'' for a threatened or endangered species means—

(i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and

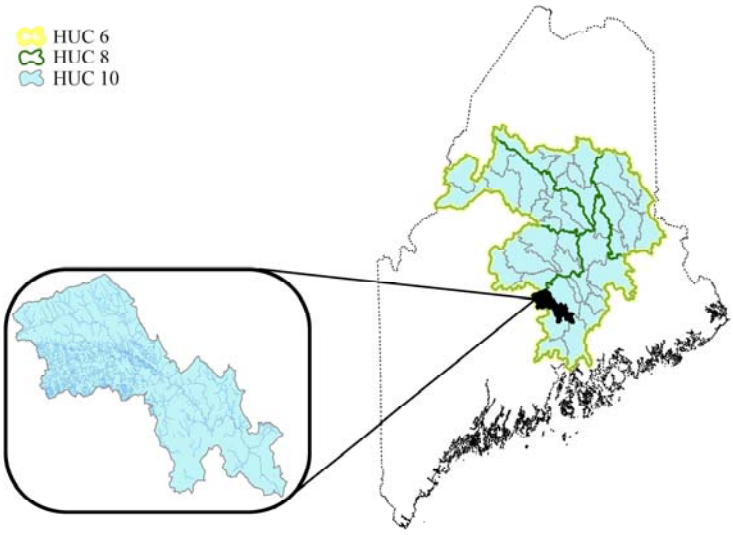
(ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species…

Excerpt from the Endangered Species Act

Another benefit of designating CH is that federal agencies are forced to clearly identify PCEs. By fully understanding what habitat features are essential, the agencies are in a better position to identify what is needed to preserve, protect or enhance those features required for the species' survival, reproduction and recovery. NEST is currently identifying the PCEs for Atlantic salmon.

Atlantic salmon have a complex life history strategy that includes freshwater and marine residencies and extensive migrations over an extremely large range. Because each life stage has very distinct and different habitat requirements, NEST must identify PCEs and designate CH for each.

Freshwater. The scale at which CH will be designated for the freshwater life stages of Atlantic salmon is at the watershed scale, or the U.S. Geological Survey hydrologic unit code (HUC) of 10 (~60-390 square miles).



Map depicting the scale at which critical habitat is designated. As an example, the basin draining the Penobscot river has a HUC of 6. The next smallest level is the sub-basin (HUC 8), which can be broken down even further into a watershed (HUC 10). This map shows the Kenduskeag watershed as it falls within the Penobscot River basin.

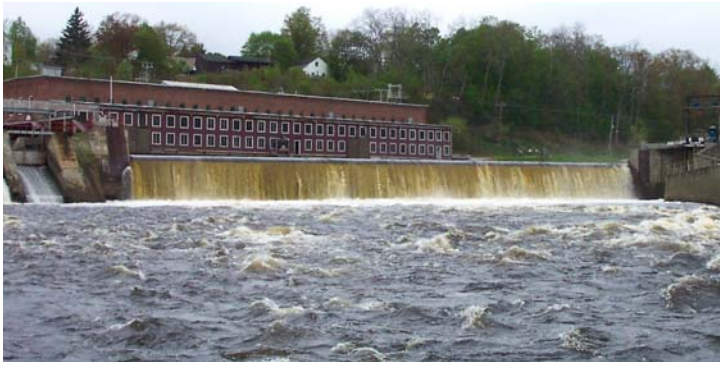
Although watersheds with naturally reproducing populations of Atlantic salmon vary widely in physical characteristics, habitat must exist within a watershed for spawning, feeding, sheltering and overwintering. Atlantic salmon habitat is often identified by life stage specific such as depth, water velocity, substrate, and cover. Some additional PCEs of freshwater habitat include:

- water quality
- instream structure
- species composition
- water chemistry
- space
- riparian canopy cover

Looking at habitat from the vantagepoint of a watershed is important because what happens on the land within a basin affects its water resources. For instance, removing *riparian* vegetation (that which borders a waterbody) eliminates an important source of nutrients and instream structure (i.e. wood debris) and can result in increased water temperature and sedimentation. Groundwater extractions can increase surface water temperatures and affect dissolved oxygen concentration. Landuse activities occurring within the drainage basin can alter water chemistry (e.g. pH). All of these activities, and many more, can result in changes in the aquatic biota, as aquatic plants and animals that are better adapted to the altered environment thrive while those that are not decline.

Two examples of freshwater habitat available in Maine for Atlantic salmon. On the left, diverse substrate provides instream structure; well rooted banks prevent erosion and minimize sedimentation and turbidity; significant canopy cover provides shade and buffers against high water temperatures; runs, riffles and pools provide a diversity of habitat for several Atlantic salmon life stages. On the right, the homogenous substrate provides little habitat diversity or instream cover; there is no refuge during times of drought, and a shade-providing overstory canopy is lacking.

As an example of the complexity of freshwater habitat required by Atlantic salmon, take the returning adult life stage. Adults return from sea to their natal river in early spring where they can spend nearly five months in a freshwater environment before spawning. Returning adults encounter many challenging conditions en route that tax their limited energy reserves and test their ability to reach their spawning grounds at the proper time for successful spawning. These conditions can include high water temperatures, extremely high/low flows, predators and obstructions.



Salmon face a variety of challenges when migrating upstream.

In order for an adult fish to survive its migration to its natal spawning grounds, holding areas en route must be available to allow for resting or to enable the fish to wait until adverse conditions (should they occur) improve before continuing upstream migration. Holding areas can include deep pools or deadwaters, lakes and ponds, and even the estuary. On occasion, an adult will reach the spawning ground weeks or even months in advance of spawning. These early arrivers require holding areas in proximity to spawning areas that provide shade, cover from predators, and protection from environmental variables such as high flows, high temperatures and sedimentation.

Some conditions a returning adult may encounter. Navigating high velocity stretches of river (right) requires an extreme energy expenditure, necessitating holding areas where adults can recuperate. If drought conditions occur (left), adults must find refuge in deep pools.

Optimal spawning habitat is gravel substrate with adequate water circulation to keep buried eggs well oxygenated. As such, spawning sites (redds) are typically positioned within flowing water to allow for percolation of water through the gravel or where upwellings of groundwater occur.

Prime spawning habitat

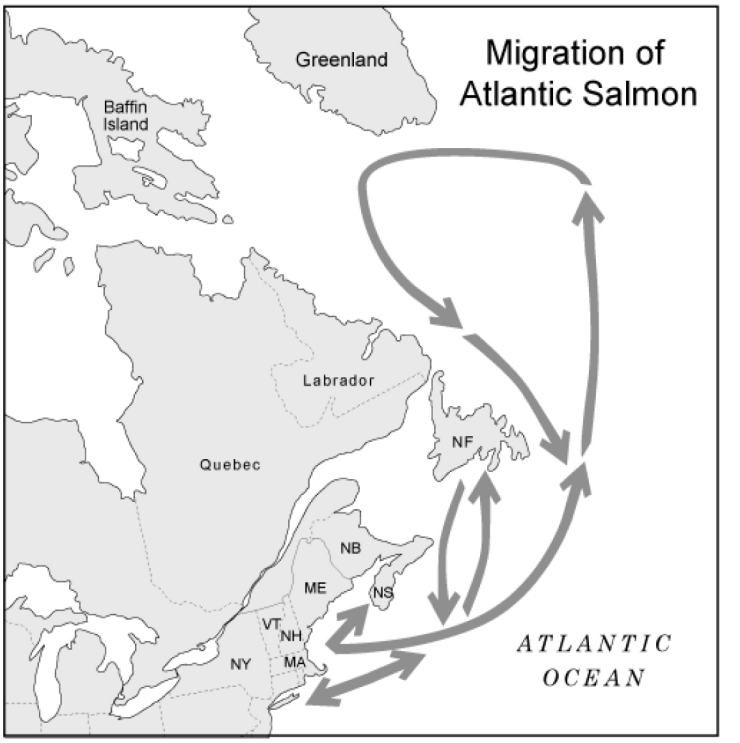
Redds that are constructed in waters that are too shallow are at risk of desiccation or freezing. Redds that are too deep may not have enough flow to allow for adequate permeation of oxygenated water through the substrate to the eggs. Additionally, water velocities that are too low can result in accumulation of fine sediments in the redd and prevent the proper cleaning of eggs, whereas flows that are too high can result in excessive scouring and cause redd excavation. Temperature also plays a critical role in egg development and therefore is vital in the timing of spawning activity so that redd development corresponds with optimal temperature requirements for egg development.

Finally, adequate space is required for successful spawning and to ensure that spawning escapement needs are met to sustain the population into the future. A typical Atlantic salmon redd encompasses slightly more then 40 square feet of spawning habitat. If sufficient space is not available, or access to spawning areas are impeded, there is an increased risk that redds will become *superimposed* by other females seeking to spawn (superimposition occurs when a female digs a redd on top of an already existing redd). The result is near complete reproductive failure of the earlier spawner.

Marine. During the smolt life history stage, juvenile Atlantic salmon undergo a physiological transformation that prepares them for life at sea. Migrating from Maine's rivers, smolts transition into estuarine and nearshore marine environments. As postsmolts, they leave the Gulf of Maine and make their way to into feeding grounds in the North Atlantic Ocean where they spend one winter before becoming adults.

The scale at which critical habitat is designated for marine life stages of Atlantic salmon falls within 300 miles of the U.S. coast. Currently, the habitat requirements of Atlantic salmon in offshore marine environments are largely unknown due to the difficulties associated with collecting data at sea. However, NESTs nearshore postsmolt trawl survey provides information related to as postsmolts feeding and behavior, and their migratory patterns.

Above, two trawlers work together to pair tow a net in Penobscot Bay. The postsmolt trawl is conducted during the smolt emigration period (late spring/early summer). The net is towed at the surface and guides postsmolts and other species occupying the same space safely into an "aquarium" at its codend. Biological information is is then obtained from these captured postsmolts and other non-target species.



Once Atlantic salmon smolts leave their natal river, they undertake a migration that takes them far from shore into the North Atlantic Ocean and as far as Western Greenland.

Western Greenland

Identification of the habitat features essential for Atlantic salmon survival and reproduction is a crucial component of the recovery process. Designating CH not only improves manager's abilities to make informed decisions but also maximize protection of essential habitat features under the ESA.

The Northeast Salmon Team (NEST) operates within the Northeast Region of NOAA Fisheries Service to promote the recovery and future sustainability of Atlantic salmon.

We are composed of fisheries managers and scientists jointly based out of the Orono, Maine Field Station; scientists based out of the Woods Hole, Massachusetts Northeast Fisheries Science Center (NEFSC) and Narragansett, Rhode Island Laboratory; and managers based out of the Gloucester, Massachussets Northeast Regional Office (NERO).

Please visit our website at **http://www.nefsc.noaa.gov/salmon/**